

REMARKS

This is a full and timely response to the outstanding Final Office Action mailed March 20, 2006. Upon entry of the amendments in this response, claims 25-29, 31-34, 36, 37, 41-45, 47-50, 52, 53 & 57-64 remain pending in this application, and claims 57-62 are withdrawn from consideration. In this submission, a response is made and reconsideration and allowance of the application and presently pending claims are respectfully requested.

Objections to the Claims

The Office Action objected to claims 27, 31, 43 and 47 stand objected to because of certain, noted informalities. Applicant has amended these claims and respectfully submits that the objections have been accommodated and therefore should be withdrawn.

Rejections under 35 U.S.C. 103

Claims 25, 26, 28, 29, 34, 36, 37, and 63 stand rejected under 35 U.S.C. 103(a) as allegedly unpatentable over *McLellan* (US patent 6,737,755) in view of *Khatri* (US patent 6,610,635). The Office Action also rejected claim 27 under rejected under 35 U.S.C. 103(a) as allegedly unpatentable over *McLellan* in view of *Khatri* and further in view of *Long* (US patent 5,175,612). Claim 31 stands rejected under 35 U.S.C. 103(a) as allegedly unpatentable over *McLellan* in view of *Khatri* and further in view of *Juskey* (US patent 5,132,778). Claims 32 and 33 stand rejected under 35 U.S.C. 103(a) as allegedly unpatentable over *McLellan* in view of *Khatri* and further in view of *Primeaux* (US patent 5,33,205). Claims 41, 42, 44, 45, 50, 52, 53 and 64 stand rejected under 35 U.S.C. 103(a) as allegedly unpatentable over *McLellan* in view of *Khatri* and *Lee et al* (US patent 6,362,530). Claim 43 stands rejected under 35 U.S.C. 103(a) as

allegedly unpatentable over *McLellan* in view of *Khatri* and *Lee et al.* and further in view of *Long*. Claim 47 stands rejected under 35 U.S.C. 103(a) as allegedly unpatentable over *McLellan* in view of *Khatri* and in view of *Lee et al.* and further in view of *Juskey et al.* Finally, the Office Action rejected claims 48 and 49 under 35 U.S.C. 103(a) as allegedly unpatentable over *McLellan* in view of *Khatri* and in view of *Lee et al.* and further in view of *Primeaux*. Applicant respectfully traverses the rejections.

With respect to claim 25, that claim recites:

25. A heat spreader ball grid array package, comprising:
 - a ball grid substrate;
 - a semiconductor chip affixed to the ball grid substrate;
 - a mounting compound encasing the semiconductor chip over the ball grid substrate;***
 - a heat spreader mounted over the ball grid substrate and spaced apart from the molding compound to form a gap; and
 - thermal grease within the gap at least between the heat spreader and the molding compound,*** wherein the thermal grease comprises silicon rubber containing heat-conducting particles, the heat spreader has a shape of an inverted square pie tin having an elongated surrounding lip mounted over the ball grid substrate and the heat spreader has a surface exposed to a surrounding ambient, not contacting the mounting compound and the thermal grease.

(*Emphasis Added*). Independent claims 25 patently defines over the cited art for at least the reason that the cited art fails to teach the claimed features emphasized above.

At page 3, the Office Action alleges that the McLellan reference teaches a molding compound 150 and an epoxy attaching material under an element 132 encasing the semiconductor chip over the ball grid substrate. Nevertheless, as illustrated in Fig. 4F and described at lines 55–65 of column 3 of the McLellan et al. reference, an epoxy material is ***dispensed*** on the top surface of the substrate 122, around the semiconductor die 124 forming glob-top material 150 (liquid epoxy). The glob-top encapsulant 150 protects the wire bonds as well as the semiconductor die 124. The glob-top material 150 surrounds a lower portion of the

adapter 132 such that the adapter 132 protrudes from the glob-top encapsulant 150. In addition, as illustrated in Figs. 4A-4B and described in lines 42~49 of column 3 of the McLellan reference, the semiconductor die 124 is conventionally mounted to an upper surface of the substrate 122 using a die attach epoxy. The adapter 132 is mounted to a portion of the top of the semiconductor die 124 for providing a thermal path away from the die. The adapter 132 is silicon and is attached to the die 124 using an epoxy.

Thus, the glob-top material 150 and the epoxy-attaching material under the element 132 cannot properly be equated to the claimed molding compound of claim 25. One reason is that the glob-top material 150 is *dispensed* on the top surface of the substrate 122 and the epoxy attaching material is an adhesive for bonding the semiconductor die and the silicon adapter. In addition, the molding compound of claim 25 of the present application is fabricated only in a single molding step rather than the above materials obviously formed by two separate fabrication steps. Further still, the McLellan reference fails to recite the thermal grease formed within the gap at least between the heat spreader and the molding compound since the silicon adapter 132 is formed within the gap between the heat spreader and the molding compound. Once the silicon adapter is used, stresses induced by the heat spreader will spread onto a dielectric layer, for example a low-k dielectric layer, on the semiconductor chip and may cause cracking thereto.

For at least these reasons, claim 25 patently defines over the cited art and is in condition for allowance. Applicant respectfully asserts that the recited references, either individually or in combination, are legally deficient for the purpose of rendering claim 25 obvious. Specifically, Applicant respectfully asserts that neither *McLellan* nor *Khatri*. teaches or reasonably suggests at least the feature/limitations emphasized above in claim 25. As claims 26-29, 31-34, 36-37 and

63 are dependent claims that depend from claim 25 either directly or indirectly, they patently define over the cited art for at least the same reasons.

With respect to independent claim 41, that claim recites:

41. A heat spreader ball grid array package, comprising:
a ball grid substrate;
a semiconductor chip affixed to the ball grid substrate;
a molding compound encasing the semiconductor chip over the ball grid substrate;
thermal grease over the molding compound, wherein the thermal grease comprises silicon rubber containing heat-conducting particles;
a heat spreader mounted over the ball grid substrate, the molding compound and the thermal grease; and
a PCB substrate or a stiffener mounted to the heat spreader, wherein the heat spreader has a shape of an inverted square pie tin having an elongated surrounding lip mounted over the ball grid substrate, and the heat spreader has a sidewall surface exposed to a surrounding ambient, not contacting the molding compound and the thermal grease.

(*Emphasis Added*). Independent claims 41 patently defines over the cited art for at least the reason that the cited art fails to teach the claimed features emphasized above.

At page 7, the Office Action alleges that the McLellan reference teaches a molding compound 150 encasing the semiconductor chip over the ball grid substrate. Nevertheless, as illustrated in Fig. 4F and described in lines 55~65 of column 3 of the McLellan et al. reference, an epoxy material is *dispensed* on the top surface of the substrate 122, around the semiconductor die 124 forming glob-top material 150 (liquid epoxy). The glob-top encapsulant 150 protects the wire bonds as well as the semiconductor die 124. The glob-top material 150 surrounds a lower portion of the adapter 132 such that the adapter 132 protrudes from the glob-top encapsulant 150. As further illustrated in Figs. 4A~4B and described in lines 42~49 of column 3 of the McLellan reference, the semiconductor die 124 is conventionally mounted to an upper surface of the substrate 122 using a die attach epoxy. The adapter 132 is mounted to a portion of the top of

the semiconductor die 124 for providing a thermal path away from the die. The adapter 132 is silicon and is attached to the die 124 using an epoxy.

Thus, the glob-top material 150 of McLellan cannot properly be taken as the molding compound of claim 41 since the glob-top material 150 is *dispensed* on the top surface of the substrate 122 and the die attach epoxy is an adhesive for bonding the silicon adapter with the semiconductor die. In addition, the molding compound of claim 41 is fabricated only in a single molding step, rather than the above materials obviously formed by two separate fabrication steps. Also, the McLellan reference fails to recite the thermal grease formed within the gap at least between the heat spreader and the molding compound since the silicon adapter 132 is formed within the gap between the heat spreader and the molding compound. Once the silicon adapter is used, stresses induced by the heat spreader will spread onto a dielectric layer, for example a low-k dielectric layer, on a semiconductor chip and may cause cracking thereon.

For at least these reasons, Applicant respectfully asserts that the cited references fail to disclose or suggest the combination of features recited in claim 41, and therefore independent claim 41 patently defines over the cited art. Specifically, Applicant respectfully asserts that neither of *McLellan* nor *Khatri* teaches or reasonably suggests at least the feature/limitations emphasized above in claim 41. Since claims 42-45, 47-50, 52-53 and 64 are dependent claims that depend from claim 41, these claims also are in condition for allowance for at least the same reasons.

As a separate and independent basis for the patentability of all claims, Applicant respectfully traverses the rejections as failing to identify a proper basis for combining the cited references. In combining the McLellan and Khatri references, the Office Action stated only that

the combination would have been obvious “to reduce messy installation with easier and less time-consuming and to reduce amount of grease with each application (*sic*).” (Office Action, page 4). This alleged motivation is clearly improper in view of well-established Federal Circuit precedent. Even more tenuous reasons were recited as constituting “motivations” for combining additional references with these two, in order to form rejections of various dependent claims.

It is well-settled law that in order to properly support an obviousness rejection under 35 U.S.C. § 103, there must have been some teaching in the prior art to suggest to one skilled in the art that the claimed invention would have been obvious. W. L. Gore & Associates, Inc. v. Garlock Thomas, Inc., 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

"The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this [invention] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. ..." Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure... In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(*Emphasis added.*) In re Dow Chemical Company, 837 F.2d 469, 473 (Fed. Cir. 1988).

In this regard, Applicant notes that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to suggest both the combination of elements and the structure resulting from the combination. Stiftung v. Renishaw PLC, 945 Fed.2d 1173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of any two or more prior art references, the prior art must properly suggest the desirability of combining the particular elements to derive a heat spreader ball grid array, as claimed by the Applicant.

When an obviousness determination is based on multiple prior art references, there must be a showing of some “teaching, suggestion, or reason” to combine the references. Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579, 42 USPQ2d 1378, 1383 (Fed. Cir. 1997) (also noting that the “absence of such a suggestion to combine is dispositive in an obviousness determination”).

Evidence of a suggestion, teaching, or motivation to combine prior art references may flow, *inter alia*, from the references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. See In re Dembicza, 175 F.3d 994, 1000, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in whatever form, must nevertheless be “clear and particular.” Dembicza, 175 F.3d at 999, 50 USPQ2d at 1617.

If there was no motivation or suggestion to combine selective teachings from multiple prior art references, one of ordinary skill in the art would not have viewed the present invention as obvious. See In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998); Gambro Lundia AB, 110 F.3d at 1579, 42 USPQ2d at 1383 (“The absence of such a suggestion to combine is dispositive in an obviousness determination.”).

Significantly, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. Winner Int'l Royalty Corp. v. Wang, No 98-1553 (Fed. Cir. January 27, 2000). The rationales relied on by the Office Action in the present application are merely generic statements, that have nothing to do specifically with the structures disclosed in the other references. As such, these rationales cannot be properly viewed as proper

motivations for combining the specific teachings of the individual references. Indeed, the generic motivations advanced by the present Office Action could be used to support a combination of ANY references, which is clearly contra to the cited Federal Circuit precedent and the clear intent of 35 U.S.C. § 103.

For at least the additional reason that the Office Action failed to identify proper motivations or suggestions for combining the various references to properly support the rejections under 35 U.S.C. § 103, those rejections should be withdrawn.

For at least the foregoing reasons, Applicants respectfully submit that the rejection can be withdrawn and requests that a timely Notice of Allowance be issued in this case.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

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